~~suspension cable~~mechanical suspension means starting immediately above the pump using a jacket or jackets attached to this single continuous structure tightly enough so that the mechanical loads are fully transferred to the mechanical suspension means as the single structure is installed into the well; and

(d.) lowering the pump into the well by playing out the ~~suspension cable~~mechanical suspension means, the ~~flexible production tubing~~tubular conduit and the electrical cable at the same rate each from a separate reel; and

(e.) locking the pump and all associated loads at the appropriate depth level in the well.

REMARKS

Reconsideration of the present application is respectfully requested in view of the above amendments and the following remarks. Amendments to the specifications and claims were made to specifically address issues brought up by the Examining Attorney in the First Office Action. No new matter is added thereby by virtue of any amendment. Applicant respectfully submits that these amendments effectively cure the objections and any informalities cited by the Examining Attorney.

I. Claims in the case

Claims 1, 2, 3, and 12 have been amended. Claims 6 and 7 have been cancelled without prejudice. Claims 1-5 and 8-15 are presently in the case.

II. Objection to the Drawings under 37 CFR 1.83(a).

The Examining Attorney objected to the drawings under 37 CFR 1.83(a). In response, the Applicant cancelled the sucker rod features from the claims. The figures as originally submitted show every feature of the invention specified in the claims. Applicant believes that the

drawings, as originally submitted, address all of the Examining Attorney's concerns.

III. Objection to the Specification

The Examining Attorney objected to the specifications because of a few informalities. In Response, Applicant has amended the specification in a fashion which Applicant believes addresses the Examining Attorney's concerns. In addition, Applicant has adopted the guidelines provided by the Examining Attorney concerning the preferred layout of the specification of a utility application.

IV. Claim Rejections Under 35 U.S.C. § 112, First Paragraph

The Examining Attorney has first rejected claims 1-11 and 13 under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Applicant has amended the specification to add a means to attach a jacket to the single continuous structure automatically as the pump is installed in such a way that one skilled in the art would know how to make and use the claimed means to make the specification consistent with claim 4 and to comply with the Examining Attorney's request. Specifically, the specification, page 8 line 4 has been amended to read as follows: An alternate method is to use an arch type banding machine for fully automated, or semi-automated banding of the three elements, an example of an applicable machine is model ST-700 from Quality Packaging Systems located in Brooklyn New York, USA. Air operated banding machines, such as the one specified, are well known in the art, and commonly used to automatically band electrical cable to production tubing in conventional submersible pump installations. To operate the automatic

bander, the operator stops the downward motion of the string, and activates the banding machine using a foot operated switch. The banding machine then automatically applies the band, tightens it, and cuts off the excess material. No new material has been added.

Claims 6 and 7 have been cancelled without prejudice.

IV. Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

The Examining Attorney has first rejected claims 1, 2, 3, 12 and 13 under 35 U.S.C. § 112, second paragraph, as the claims as originally filed are indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicant has amended claims 1(d), 2 and 3 to change "suspension cable" for --mechanical suspension means-- which makes those claims consistent with the specification and in compliance with the Examiner Attorney's request. The antecedent basis for the mechanical suspension means can be found in the specification, page 6 line 3.

Applicant has amended claim 12 to eliminate the imitations "the suspension cable, production tubing, and electrical cable to the pump" in sub-part a., and "the flexible production tubing" in subpart d. The antecedent basis for the mechanical suspension means, flexible tubular conduit and jacket or jackets added to claim 12 can be found in the specification, page 6 lines 3-17, and page 7 lines 14-22. No new matter has been added.

Applicant has amended claim 13 to replace "jacket" for --jacket or jackets--. The antecedent basis for the jackets can be fount in page 7 lines 14-22. No new matter has been added.

V. Claim Rejections Under 35 U.S.C. § 102

The Examining Attorney rejected claims 1, 2, 4 and 11 as being anticipated by Phillips (US

Patent 4,553,590) under 35 U.S.C. § 102. Applicant respectfully submits that Phillips does not anticipate any of the Applicant's claims, and offers the following argument in support thereof.

Phillips states in page 2, column 4 line10, the summary of the invention that: "[T]he support cable, power cable and hose are all encased in a protective sheath to make a single flexible line". Applicant does not dispute that Phillips discloses the three basic elements disclosed in the present invention. The critical difference, however, is that Phillips does not provide a means to accommodate the differential expansion of the elements when in use. The problem addressed by this invention was discovered as far back as the early 70's when cable suspended submersible pumps were first deployed to the field. In these early systems suspension cables and power cables were joined in a manner similar to Phillips (then suspended inside a liner pipe to convey fluid) as for example, taught by Arutunoff (US patent 3,411,454). The results of these early deployments were failures by unstable buckling of one of the elements of the combined line (usually the electrical cable) after the combined line is installed in the well. Applicant personally tore down 7000' of line similar to that described by Phillips that failed after only one deployment. This serious problem is well know in the art and is not addressed by Phillips, and is one of the major problems solved by the present invention.

The invention of Phillips would have surely suffered the same type of failure in the field due to the failure to compensate for differential expansion of the elements.

Brookbank (4,681,169) teaches in page 2, column 3, lines 23-35 that by using separate support and conductor cables, the thermal properties of the electrical power cable do not affect the support cable, and thermal expansion does not apply compressive stresses to the copper conductors of the electrical cable. Once the phenomena was discovered by testing, simple calculations show

why it is required to accommodate thermal (and other types) of expansion of the elements.

When the combined assembly is first installed, all of the elements are the same length, but vary in stiffness and load. The load bearing element (the suspension cable) will lengthen and rotate under load. The attached electrical cables would also get longer as they are firmly attached to the suspension cable, and the start out the same length on the reel. In most cases, the suspension cable stretches elastically, but because of the characteristics of materials used as electrical conductors (most are almost pure metals with low yield strengths) they will stretch beyond the elastic limit and when the load is removed, the electrical cable will be longer than when it was first deployed, while the suspension cable will return to it's original length. The additional length can be as much as 5' per 1000' deployed. If appropriate compensation for differential expansion is not provided, the electrical cable will return to the reel in knots, as the present inventor has personally witnessed.

Another problem occurs when the flexible hose is added to the combined suspension cable and electrical cable. When additional loads are applied, for example when pressure from the pump is applied to the flex tubing or when electrical cables are heated due to the flow of current, they will lengthen considerably over large distances found in the field. For example, most flex hoses will grow 2% or more when under pressure. Over 2000', 2% stretch would be 40'! Clearly, the Phillips design does not adequately account for this well known property of flex hoses and electrical cables and the resulting combined line would fail and not be useful for the purposes intended. That problem has been adequately demonstrated to occur in suspension cable hardware over the history of the work in this field.

The same principles apply to the invention of Brookbank (4,681,169) but to a lesser extent because flex hoses are not part of his invention. As illustrated by the Brief Description of the

Invention (page 1, column 1 line 46), "a continuous length of electrical power cable, a continuous length of support cable, and a continuous length of cable carrier ...", all elements are continuously bound together in the well, and must substantially move together. Small expansions can be tolerated, but large ones would result in buckling failure due to differential expansion. The invention of Brookbank solves the problem of the stretching of the electrical cable by separating the suspension cable from the electrical cable at the surface, eliminating the knots on the reel, but if a flex hose is added to Brookbank's invention, the resulting apparatus would be incapable of compensating for the differential expansion that occurs when the tubing is pressurized. The lengthening of the flex tubing due to pressure is much larger then the lengthening of the electrical cable due to self heating. Accordingly, even with only the suspension cable and the electrical cable, the invention of Brookbank would be of marginal usefulness due to the expansion of the electrical cable resulting from self heating, and the lack of a mechanism to compensate for such expansion. Physically separating the power line from the suspension cable clearly improves the situation of differential expansion, but cannot compensate for large expansions such as those found when flex hose is pressurized.

Clearly the present invention is not anticipated by either Phillips or Brookbank, as neither of those inventions adequately provides for the expansion of the flexible tubing and associated shortcomings, while the present invention does.

IV. Claim Rejections under 35 U.S.C. § 103

Claims 3, 5, 8, and 9 have been rejected as being unpatentable over Phillips in view of US patent 5,524,708 to Isaacs. As discussed in the previous section, Phillips does not provide for the differential expansion of the three elements in the "single flexible line" and therefore does

not provide a solution to the problem of powering, suspending, and providing a flow conduit to the surface that characterizes the three main functions required to operate a submersible pump in a well. Phillips, therefore, does not render obvious the solution to those problems provided by the present invention. The addition of the element introduced by Isaacs, namely the modified tubing does not solve the problem of differential expansion in the "single flexible line". A single flexible line containing the suspension means, and electrical cable of Phillips plus the modified tubing of Isaacs would still fail due to the problems outlined in the previous section. Neither Phillips nor Isaacs solve the differential expansion problems unique to submersible pumps nor do those patents render obvious the solutions provided by Applicant. The current invention solves the problems of differential expansion of submersible pumps by using a completely different construction technique that is not seen in, or obvious from, either Phillips or Isaacs individually or when viewed in combination. Applicant respectively submits that the solution to the differential expansion problem would not be obvious to one of ordinary skill in the art at the time of the invention based on Phillips in combination with Isaacs.

These same arguments apply to the rejection of claim 10 under 35 USC 103(a) Neither Phillips or Brookbank provide for differential expansion of the elements of the "single flexible line", especially the large expansions experienced by the flexible tubing. As the present invention does account for this differential expansion, the use of armored cable in such a system could be an advantage over unarmored cable. The argument of obviousness does not apply when the solution to the problem of differential expansion is not provided by, or rendered obvious from, either Phillips or Brookbank individually or when viewed in combination.

The rejection of claims 12-15 under 35 USC 103(a) is based on Cox (5,180,014) in view

of Brookbank. Cox solves the problem of suspending the submersible pump, supporting the electrical cable, and providing a conduit to the surface in more or less the conventional manner: by having the tubing provide the functions of a conduit to the surface and is the suspension member to which the electrical cable is attached for support. Cox provides a method to continuously inject the tubing in the well while banding the electrical cable to the continuous tubing. The rejection is based on the premise that one ordinarily skilled in the art would combine the electrical cable and coiled tubing string disclosed in Cox with the suspension cable as disclosed in Brookbank. First of all, the flexible tubing disclosed in Cox must have sufficient strength to support the loads of the electrical cable and the submersible pump to use the method disclosed by Cox, so the addition of a suspension cable as disclosed by Brookbank would not be required, and would not make sense unless the use of low strength flexible tubing were proposed, which is not disclosed, claimed, proposed or even suggested by Cox or Brookbank. The present invention provides an additional element, namely low axial strength flexible tubing, that is not disclosed or claimed in either the Cox or Brookbank patents. Unlike the flexible tubing disclosed in Cox, low strength flexible tubing such as used in the present invention, expands significantly under applied pressure. Neither the method of Cox, nor the method of Brookbank, or Cox in view of Brookbank, provide a method to account for low axial strength flexible tubing of the present invention, and would not provide for the method for installing a submersible pump with low axial strength tubing as described in the present application.

Reconsideration of the application is hereby requested.

Respectfully submitted,

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